Using Spatial Statistics to Investigate Production Trends in the Bakken Petroleum System

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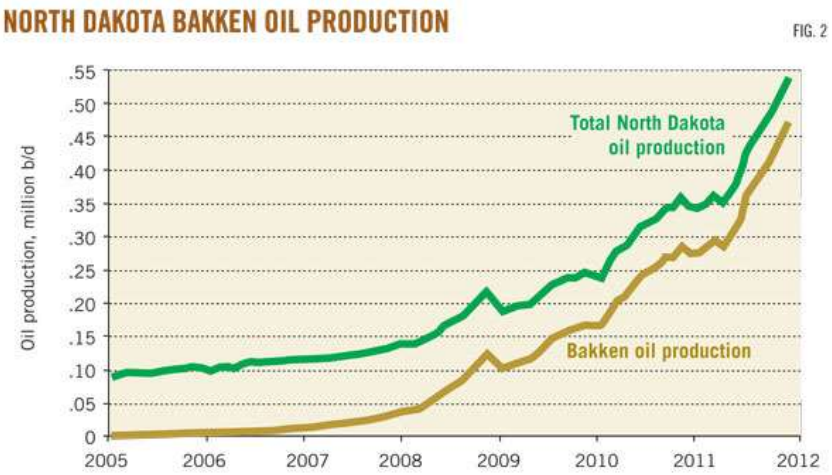
Purpose of the Investigation

- Increasing oil production in North Dakota
  - Bakken Formation
  - Three Forks Formation
- Better understanding of the locations of areas with high yield
- Addressing areas that may require further investigation



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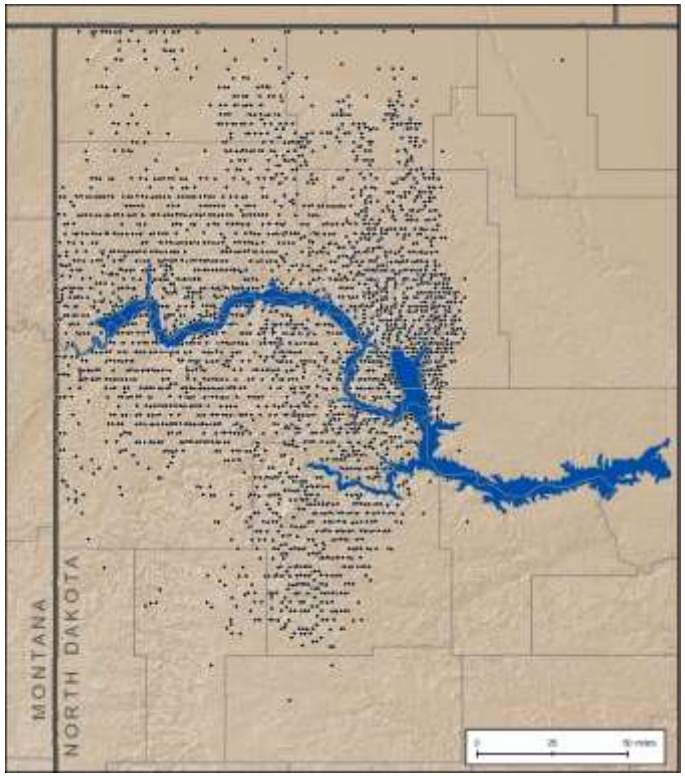
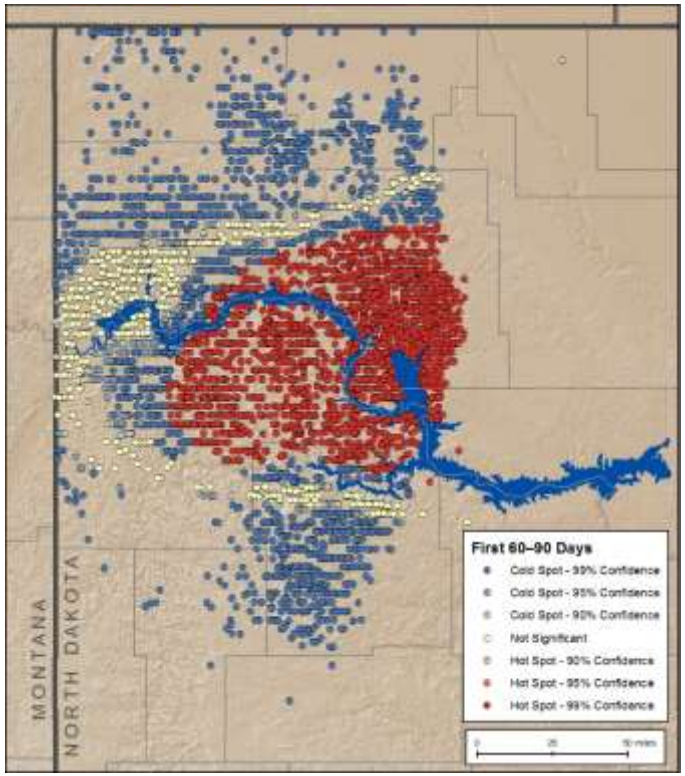
Data Acquisition

- Data was collected from the North Dakota Industrial Commission (NDIC) Web site.
- Query was created so only Bakken producing wells are represented.
- First 60–90 days of production were used.
  - These are production days not calendar days.



Choosing the Right Tool
Hot Spot (Getis-Ord Gi*)

- Identifies statistically significant clusters of high/low values.
- Output creates a z-score (standard deviation) indicating whether the observed spatial clustering is more pronounced than expected.



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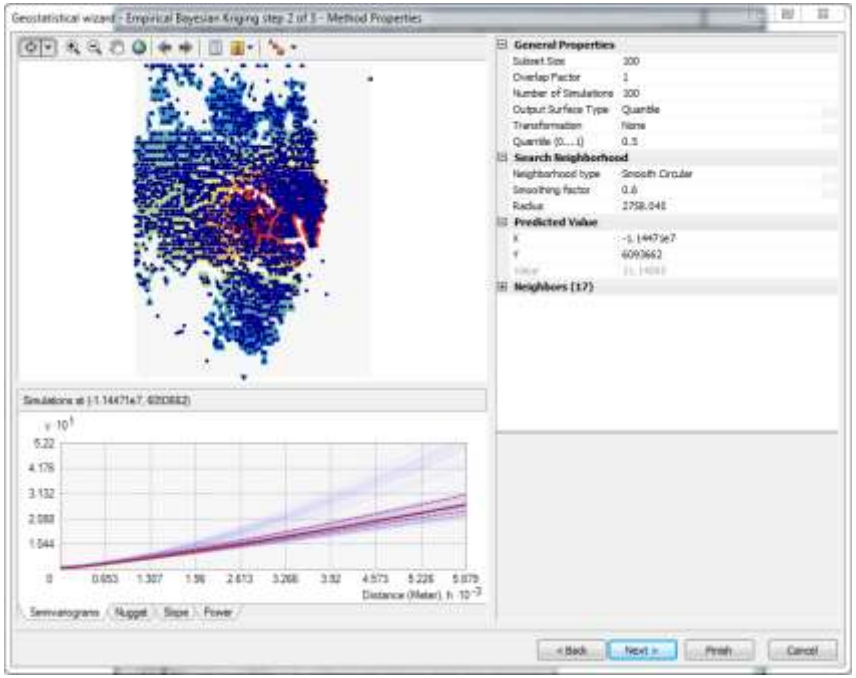
Why Empirical Bayesian Kriging?

- Employs a weighted least squares approach.
- Skewing of data.
- Empirical Bayesian kriging automatically calculates parameters.
- Accounts for the error introduced by estimating the underlying semivariogram.



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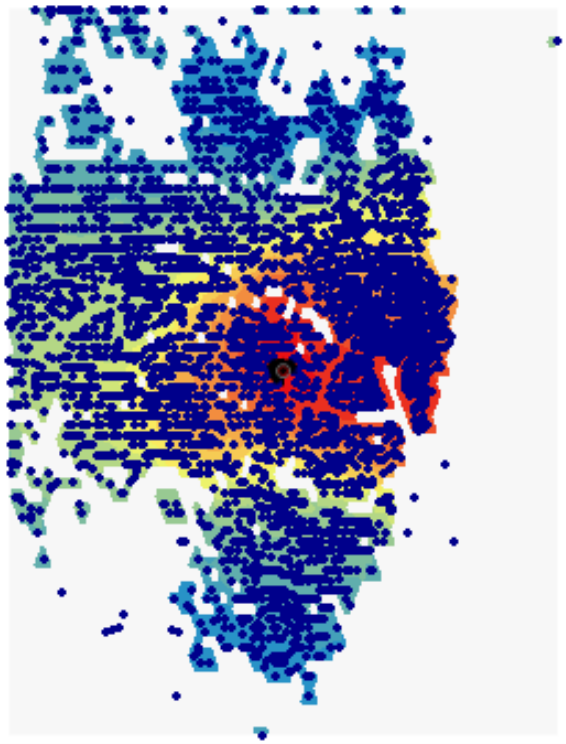
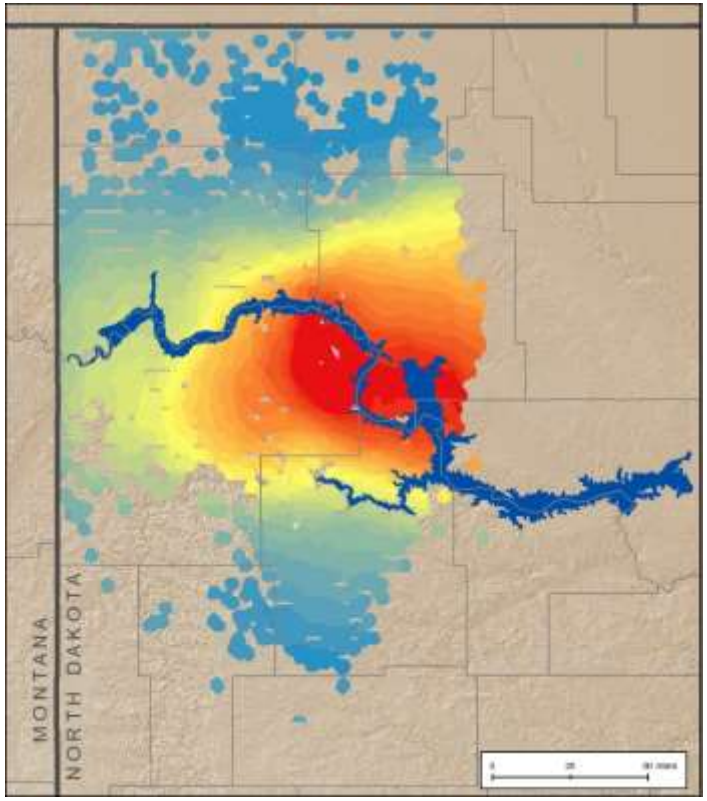
Using All Z-Score Information





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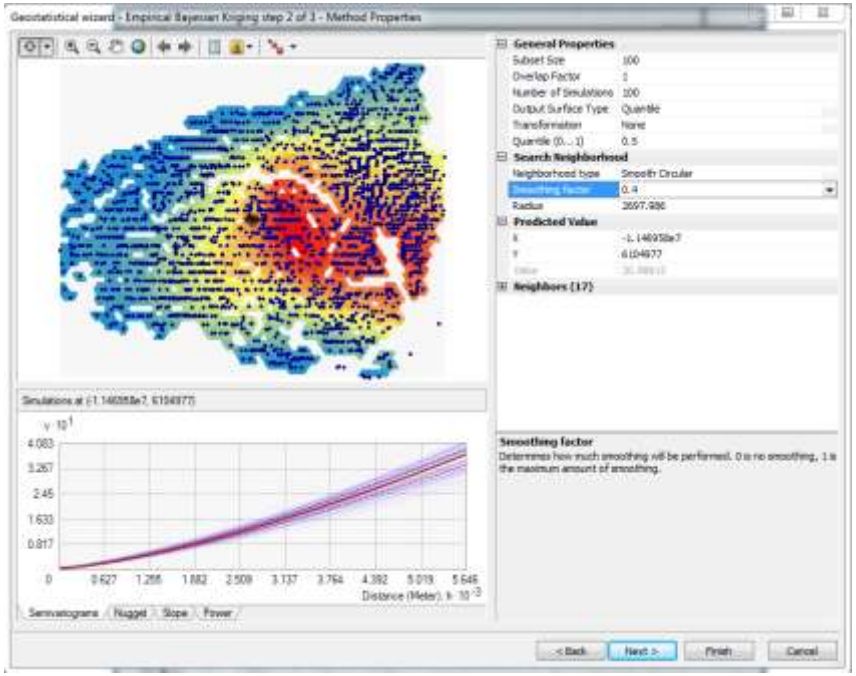
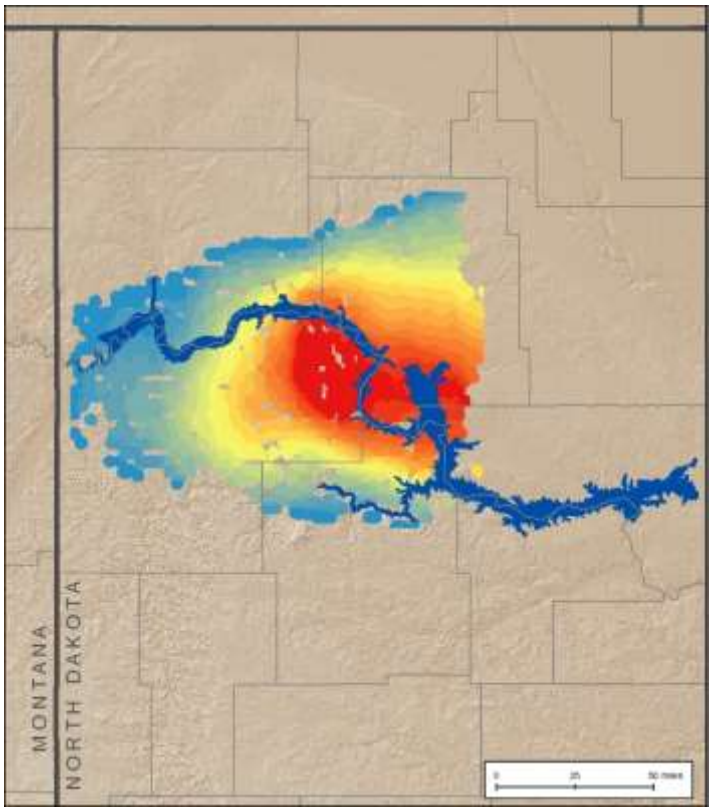
Using Only Positive Z-Score Information





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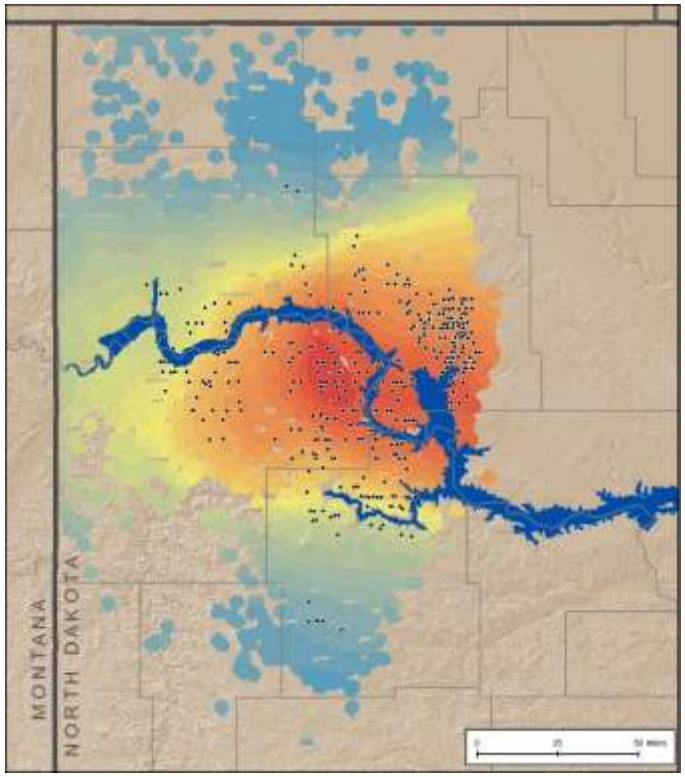
Top 10% of Production Wells

- Wells producing 90,000 or more barrels in the first 60–90 days of production.
- The outliers to the north and south do not skew the data overall because of the use of hot spot analysis prior to kriging.



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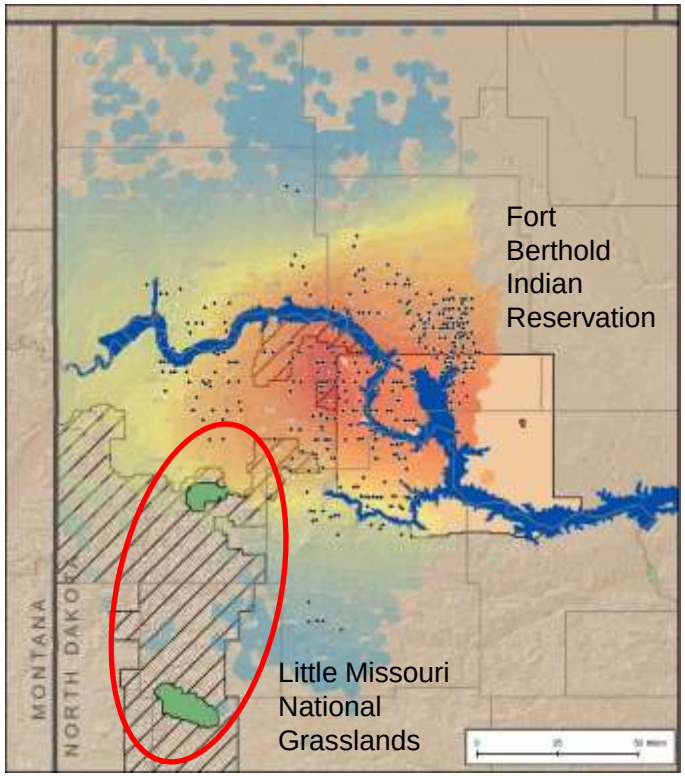
What to Do with the Results?

- Further evaluation of “holes” in production:
  - National grasslands
  - National parks
  - Indian reservations
- Areas of exceptional production may provide valuable insight.
- Recompletion of wells in high-producing areas:
  - Well integrity



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Questions?

References

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